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(56) Documents cited
GB 2022063 A

(58) Field of search
UK CL (Edition L) B5A AT14E, B8T TTB TTC
INT CL⁵ B29C 45/26 45/44, B65D 41/34 55/02

(54) Injection moulding a tamper evident closure

(57) A tamper evident container closure comprising a cap 20 and tamper evident band 21, of outer diameter less or equal to the outer diameter of the cap, is formed in a mould comprising a core 35 defining the inner profile of the closure and an axially movable sleeve 37 arranged around a portion of the core, only axial movement of the mould parts being necessary to release a closure therefrom. A cavity 39 is defined between the core 35 and sleeve 37 to form the tamper evident band 21 of the closure, a shoulder 40 formed in the core being in contact with the inner surface 41 of the sleeve 37 so as to space the band 21 from the cap 20 of the container and the inner surface 41 of the sleeve 37 being formed with axially extending grooves 42 so as to connect the band defining cavity 39 with the cap forming cavity 38. The grooves serve to allow the formation of frangible bridges 22 and gaps 23 between the cap 20 and band 21 in the closure. These bridges 22 extend along the outer surface of the band 21 as ribs 24. A further mould part 31 defines the external profile of the cap and abuts the upper, planar surface of the sleeve 37, the core 35 and the sleeve 37 being removed axially from the part (31, (Figure 7). The tamper evident band 21 may be moulded to carry an internal bead or ratchet teeth for engagement with complementary projections on a container top.

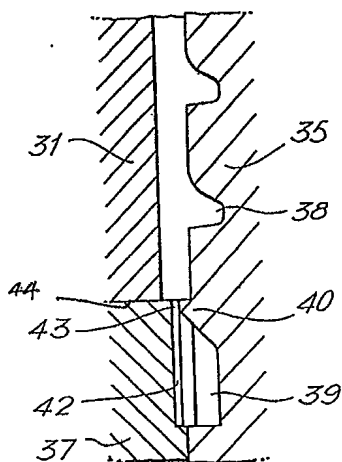


FIG. 10

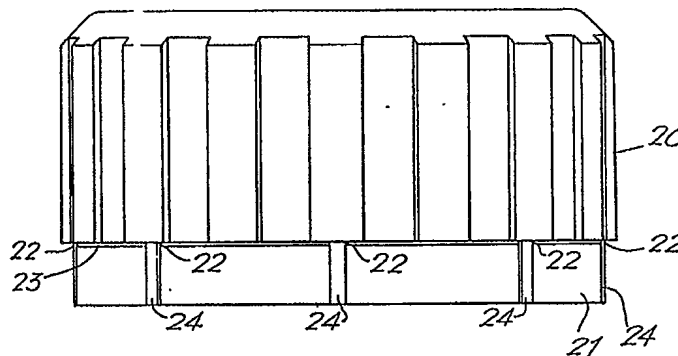


FIG. 3

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

The print reflects an assignment of the application under the provisions of Section 30 of the Patents Act 1977.

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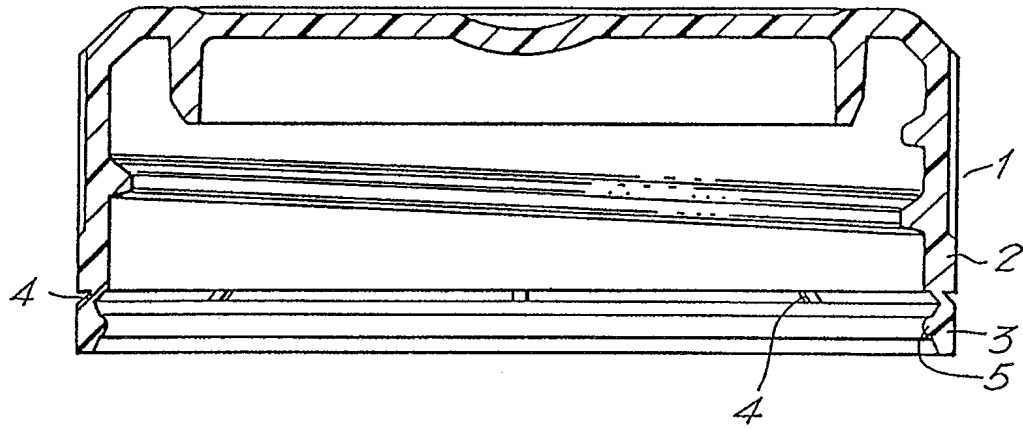


FIG. 1

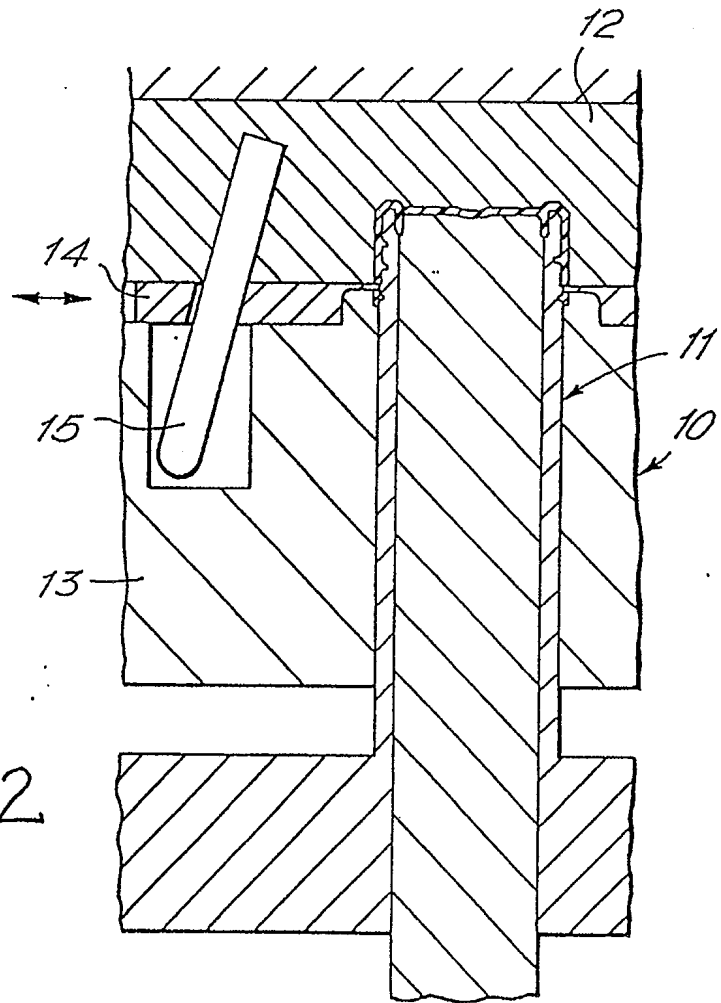


FIG. 2

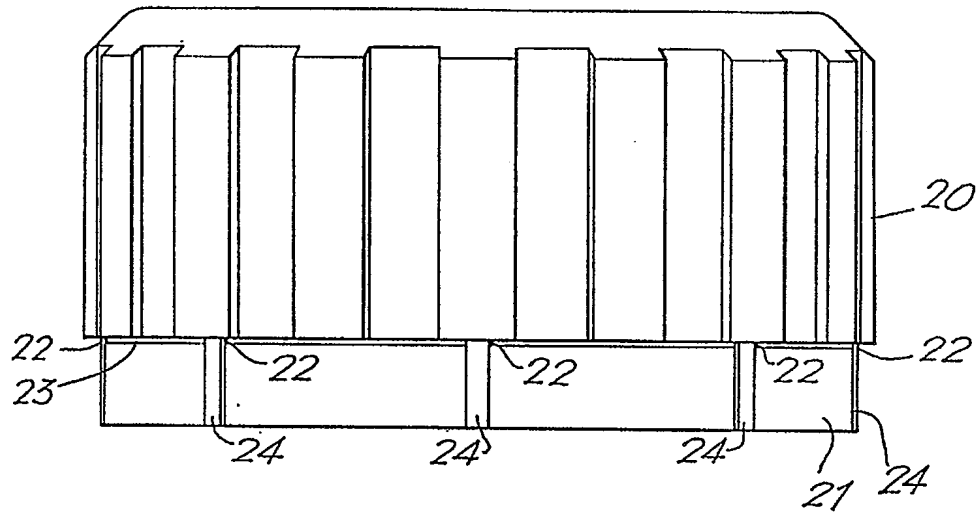


FIG. 3

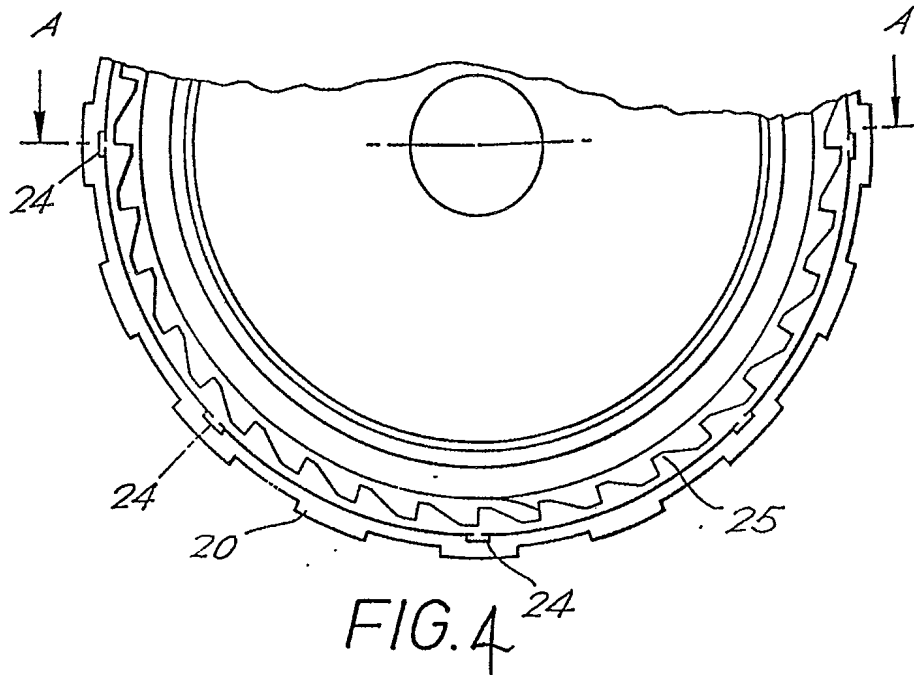


FIG. 4

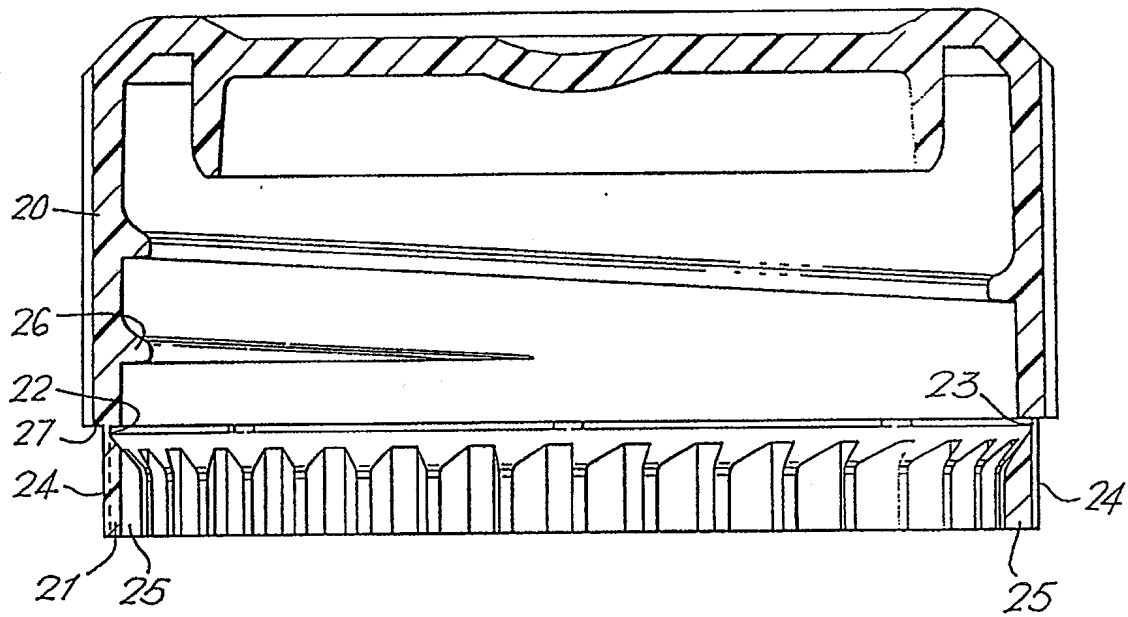


FIG. 5

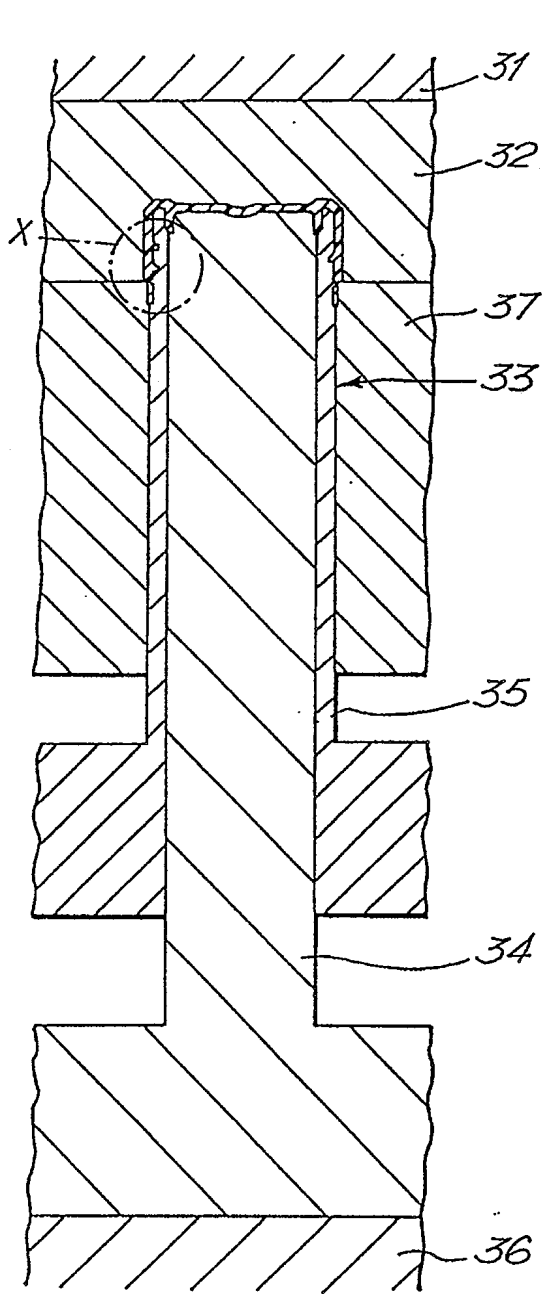


FIG. 6

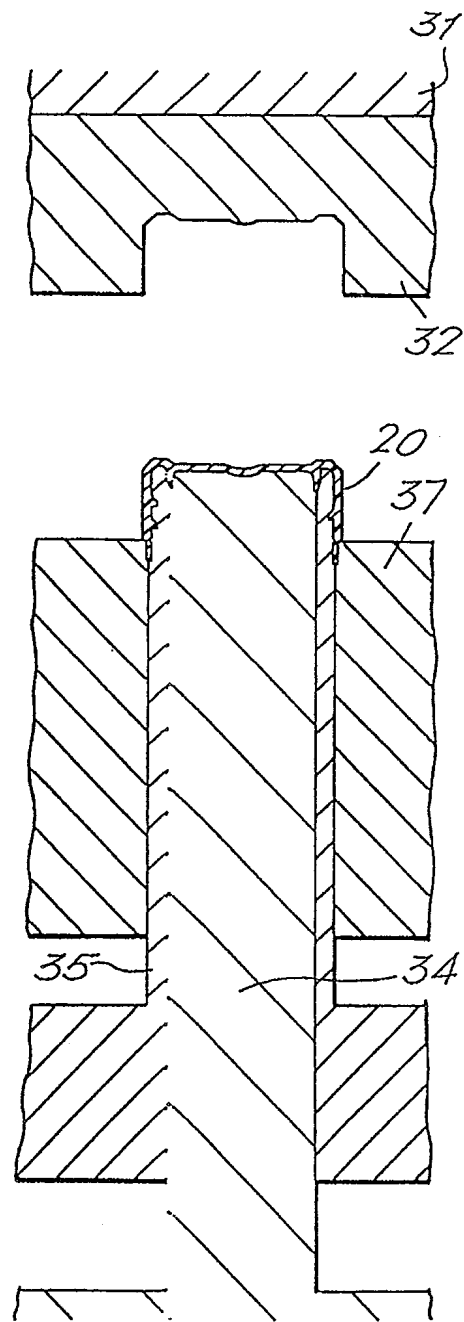


FIG. 7

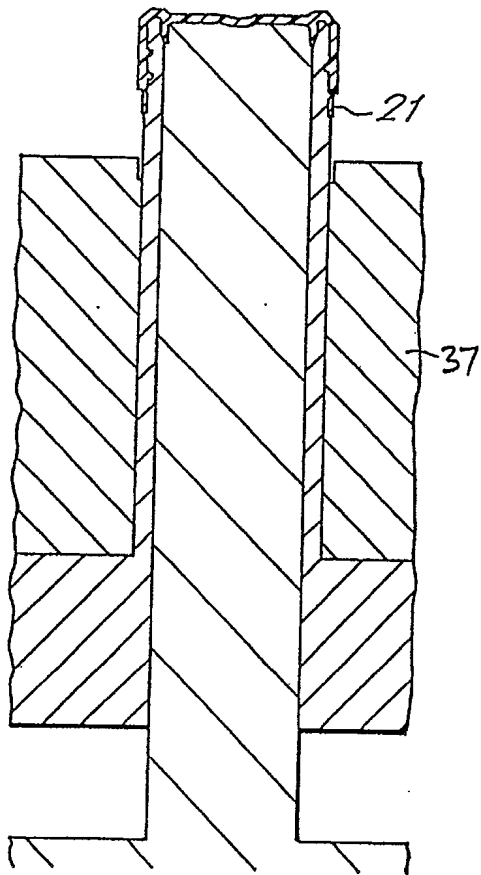
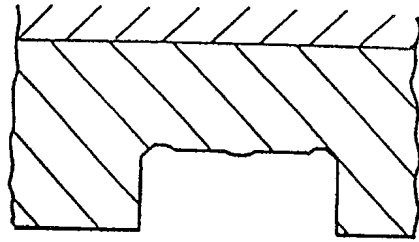
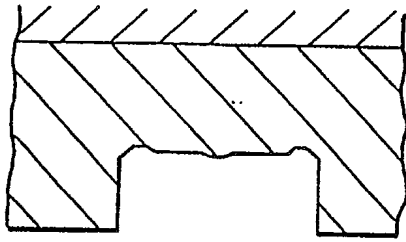


FIG. 8

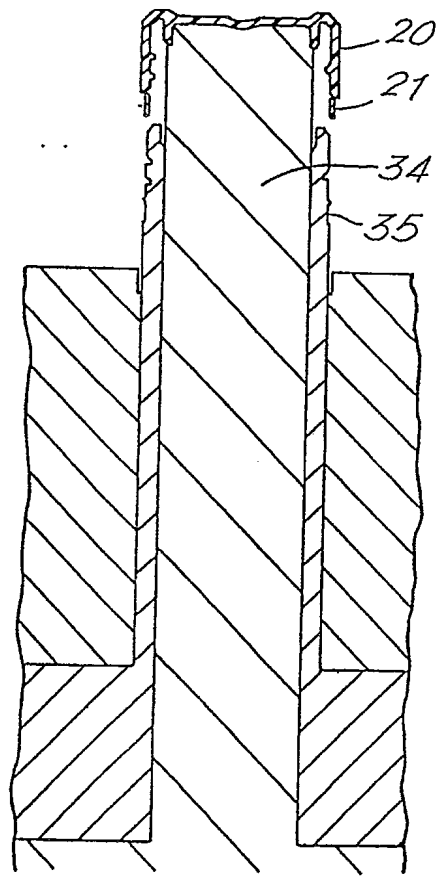


FIG. 9

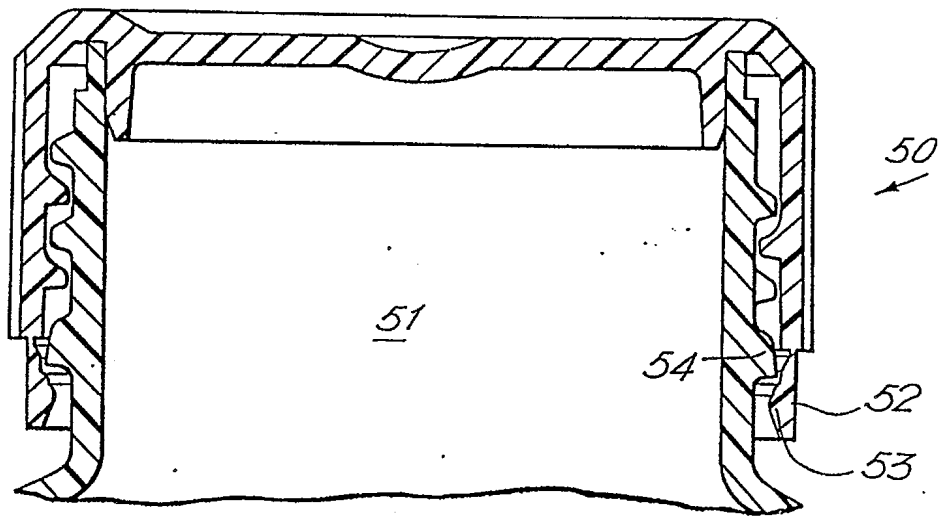


FIG. 12

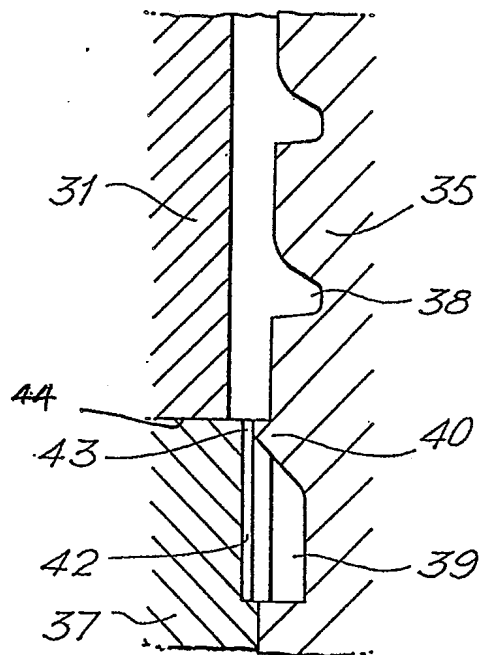


FIG. 10

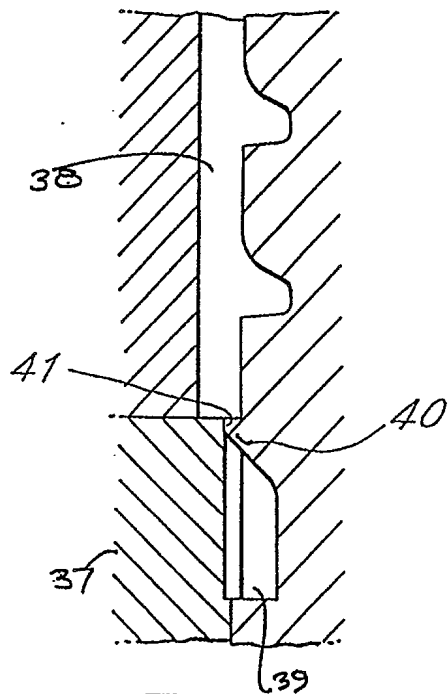


FIG. 11

Container Closure

5 The present invention relates to so-called tamper
evident container closures and methods and apparatus for
producing such containers.

10 Tamper evident closures may take several forms. In
the so-called 'top hat' form, a tamper evident band is
attached to a lower part of the closure cap by radially
extending, frangible bridges, and has a diameter larger
than the cap itself. The inner surface of the band is
provided with ratchet means for engagement with ratchet
teeth formed on a container body.

15 A more aesthetic form of closure is the straight-
sided closure in which the tamper evident band is of the
same or of a smaller diameter than the cap. The band
may be in the form of a tear band having ratchet teeth
on its inner surface, and attached to the cap by a
continuous, thin membrane. The band is removed by
20 pulling a tearing tab formed on the band, which
separates from the cap at the weakened membrane. Such a
cap is shown in GB-A-2097366. In an alternative
construction, a band, which may have ratchet teeth or a
circumferential bead for engaging with a complementary
25 formation on the container, is joined to the cap by a
number of frangible bridges, separated by
circumferentially extending slots. The band is spaced
from the lower edge of the cap by the bridges.

30 The problem with straight-sided closures is that
they are difficult to manufacture. In the tear band
construction, the upper surface of the tear tab is
formed by a radially movable slide part which must be
retracted from a moulding position when the mould is
opened to allow the closure to be removed from the
35 mould.

Similarly in the frangible band construction, the
circumferential gaps between the respective bridges are
formed by respective movable slides extending, in a

moulding condition, to abut a core member in the mould. The slides must again be retracted radially upon opening of the mould to allow the closure to be removed.

Not only does the provision of radial slides
5 considerably complicate the mould construction, and thus increase its cost, but the operative portions of the slides are very thin and liable to breakage, which results in down time in production.

The present invention seeks to provide an improved
10 method and apparatus by which container closures of the straight-sided frangible bridge type may be produced.

From a first aspect the invention provides a method of making a container closure having a cap and a tamper
15 evident band of a diameter substantially equal to or less than the diameter of the cap and attached thereto at circumferentially spaced locations by frangible bridges, comprising the steps of:

providing a mould having a core for defining the inner profile of said closure, said core having an
20 external circumferential surface portion arranged above a portion defining the inner profile of said band, and a sleeve mounted for axial movement relative to said core and having an inner surface with a diameter substantially equal to the external diameter of said
25 circumferential surface portion of said core, with axially extending grooves formed in said inner surface;

closing said mould with said sleeve surrounding said external circumferential portion of said core such that the inner surface of the sleeve between said
30 grooves is substantially in contact with said external circumferential surface of the core and is spaced from said core therebelow to form a band forming cavity;

injecting plastics material into the mould such that plastics material enters both said grooves in said
35 sleeve so as to form said frangible bridges and the cavity formed between the sleeve and the portion of the core below the external circumferential surface portion to form the band;

axially moving said sleeve and said core relative to one another such that the sleeve no longer surrounds said band; and

removing the closure from said core.

5 From a second aspect, the invention provides a mould for forming a container closure having a cap and a tamper evident band of a diameter substantially equal to or less than the diameter of the cap and attached thereto at circumferentially spaced locations by
10 frangible bridges, comprising:

a core for defining the inner profile of said closure and having an external circumferential surface portion arranged above a portion defining the inner profile of said band;

15 a sleeve which is mounted for axial movement with respect to said core and has an inner surface with a diameter substantially equal to that of said external circumferential surface of said core, with grooves extending axially along said inner surface;

20 said core and said sleeve being adapted so as to be capable of assuming a relative position in which the sleeve surrounds the core with the portions of its inner surface between the grooves substantially in contact with the external surface of the core so as to define in
25 the moulded closure a gap between the cap and the band, the grooves acting to form the frangible bridges in the moulded closure.

Thus in accordance with the present invention, the bridges are formed by grooves formed in the inner
30 surface of a core-contacting sleeve, and which provide communication between a cap forming cavity and a band forming cavity of the mould. The gaps between the frangible bridges are formed by the contact, in the mould, between the inner surface of the sleeve and an
35 external circumferential portion of a core part. The bridges formed by the grooves will appear as ribs on the external surface of the band. There is no need for radially movable parts to form the gaps between the

bridges, since the bridges are formed essentially on an outer surface of the band, rather than as extensions of the upper surface thereof as in the prior art. The phrase "substantially in contact" as used above is
5 intended to reflect that in practice, to allow the sleeve and core to move relative to one another, to allow for manufacturing tolerances and because of component wear, the inner diameter of the latter will normally be slightly larger than the diameter of the
10 external surface on the core. The difference in diameters should, however, be such that ordinarily plastics material would not flow into any gap between them, although some flashing may occur in this region in practice.

15 Preferably the respective grooves extend along the sleeve to the extent that the ribs in the finished cap extend along substantially the entire axial length of the band. This is of course, not essential, and the ribs may only extend a fraction of the axial length of
20 the band, since so long as they extend at least some distance down the band, the bridges will be satisfactorily connected therewith.

A third mould part, for defining the external profile of the cap preferably abuts on the upper surface
25 of the sleeve, which may be planar or have a step and which may define a radially outer portion of the lower surface of the cap. In such an arrangement the bridges will be spaced inwardly from the outer edge of the cap's lower surface. The radially inner portion of the cap's
30 lower surface is preferably formed by a shoulder formed in the inner core above the aforementioned circumferential surface portion in contact with the sleeve. Preferably in the mould closed position, the shoulder is at the same level as the upper surface of
35 the sleeve.

The particular position of the bridge on the lower surface of the cap will be determined by the relative dimensions of the shoulder and the sleeve. Preferably,

however, the shoulder and sleeve are such that the bridge is generally formed at about half the thickness of lower surface of the cap.

5 The tamper evident band may be of the ratchet tooth or bead type, so the core may be suitably shaped so as to generate the desired band inner profile.

10 The depth and circumferential extent of the grooves should preferably be such as to allow molten plastics material to flow from the cap forming portion of the mould into the space between the sleeve and the lower portion of the core to form the band. They should not be so large, however that the bridges finally produced cannot be broken when it is desired to remove the closure from a container.

15 The invention also extends to a container closure made by a method of or in a mould of the invention. It also extends to cover a container closure comprising a cap and a tamper evident band arranged at a spacing from a lower edge thereof, said band having a diameter 20 substantially equal to or less than the diameter of the cap, and being connected to said cap by a plurality of circumferentially spaced frangible bridge members, said bridge members extending downwardly from said cap to form respective ribs on the outer surface of said band.

25 Some preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying figures in which:

Fig. 1 shows a prior art container closure;

30 Fig. 2 shows schematically a stage in production of the closure of Fig. 1;

Fig. 3 is an elevation of a closure made in accordance with the invention;

Fig. 4 is a scrap underneath plan view of the closure of Fig. 3;

35 Fig. 5 is a sectional view along A-A in Fig. 4;

Figs. 6 to 9 illustrate steps in a method in accordance with the invention;

Fig. 10 shows an enlarged scrap section of the

region X of the mould of Fig. 6, at a position where a bridge will be formed in the finished closure;

Fig. 11 shows a similar new to Fig. 10, only taken at a position between bridges in the finished closure;
5 and

Fig. 12 shows an alternative form of closure made in accordance with the invention.

Referring to Fig. 1, a tamper evident closure 1 comprises a cap 2 and a tamper evident band 3. The band
10 3 is attached to the cap by a plurality of circumferentially equispaced frangible bridges 4. The band 3 is provided with a bead 5 which, when the closure is screwed on to a container top engages over a flange on the container. When the closure is unscrewed from
15 the container, the bead 5 is retained by the flange on the container, and further unscrewing causes breaking of the bridges 4.

Fig. 2 shows schematically a mould 10 for producing a closure as shown in Fig. 1. A two-part core 11 is
20 suitably formed with an external profile to form the internal profile of the closure. An upper mould part 12 defines the cap outer profile, while a sleeve 13 defines the outer profile of the band 3. The cap forming cavity of the mould (formed between the upper mould part 12 and the core 11) is separated from the band forming cavity
25 (formed between the sleeve 13 and the core 11) by a plurality of circumferentially arranged radial slides 14 which, when the mould is closed extend to contact the core 11. A small circumferential gap is left between
30 the slides so as to form the bridges 4. When the mould is opened, a pin 15 mounted in the upper mould part 12 causes the slide 14 to retract radially so that the closure may be removed from the mould. Such an arrangement suffers from the drawbacks mentioned
35 earlier.

With reference now to Figs. 3 to 5, a closure made in accordance with the invention comprises a cap 20 and a tamper evident band 21 having a smaller diameter than

the cap 20, and attached thereto by eight circumferentially equispaced frangible bridges 22. The upper surface of the band 21 is spaced from the lower surface of the cap 20 by a gap 23. The bridges 22
5 extend down the external surface of the band 21 as ribs 24. The internal surface of the band 21 is provided with ratchet teeth 25 for engagement with complementary teeth on a container top. The cap 20 is formed with a screw thread 26 for engagement with a complementary
10 thread on the container neck.

As can be seen from Fig. 5, the bridge 22 is connected to the lower surface 27 of the cap 20 approximately at half the thickness of the cap wall.

Figures 6 to 11 describe a preferred method and
15 apparatus in accordance with the invention.

A mould 30 comprises a fixed platten 31, an upper mould part 32, a core 33 comprising an inner core part 34 and an outer core part 35 slidably mounted thereon. The inner core part 34 is mounted on a movable platten
20 36. A sleeve part 37 is slidably mounted on the outer core part 35.

Figure 6 shows the condition when the mould is closed. A closure forming cavity is defined between the various mould components, and molten plastics material
25 admitted to the cavity by feeders (not shown).

As can be seen more clearly from Fig. 10, a cap-forming cavity 38 is defined between the upper mould part 31 and the outer core 35, and a band-forming cavity 39 between the upper part of the sleeve 37 and the core
30 35.

The outer core 35 is formed with a circumferential shoulder 40, the upper surface of which forms the lower inner edge of the cap 31. The upper portion of the sleeve 37 has an inner surface 41 having a diameter
35 which is equal to the external diameter of the shoulder 40, and when the mould is closed, it contacts the shoulder 40 substantially around its whole circumference as shown typically in Fig. 11. This effectively

separates the cap-forming cavity 38 and band-forming cavity 39 over substantially the whole circumference of the cap. However, the inner surface 41 of the sleeve 37 is formed with longitudinally extending grooves 42 which
5 extend up to the upper surface 44 of the sleeve 37, which forms the outer portion of the cap lower edge. Thus at circumferentially spaced locations, the cap and band forming cavities 38,39 are connected by the grooves 42.

10 Thus when the molten plastics material is introduced into the mould, it may flow through the grooves 42 from the cap-forming cavity 38 to fill the band-forming cavity 39. The material which solidifies in the upper part 43 of each groove 42 will form a
15 connecting bridge 22 in the finished closure with the material in the remainder of the groove 42 forming the external rib 24 on the band.

Once the molten material has solidified sufficiently, the lower mould parts 33-37 can be moved
20 away from the upper mould part 32 as shown in Fig. 7, to leave the closure member 20 exposed on the top of the core 33. The sleeve 37 is then moved axially downwardly relative to the core 33 to release the band 21 (Fig. 8). Because the bridges 22 in the closure are formed by the
25 grooves in the inner surface of the sleeve 37, the sleeve 37 may be so moved without in any way interfering with the band 21. The outer core 35 is then moved down with respect to the inner core 34 to release the cap from the outer core (Fig. 9). The plastics material
30 will at this time still be sufficiently hot and elastic to allow the interengaging formations on the closure and the core to disengage axially. Finally the closure is removed from the inner core 34 by a jet of compressed air emitted through an opening (not shown) in the top
35 surface of the inner core 34.

Figure 12 shows an alternative construction of closure 50 made in accordance with the invention, and in position on the top of a container 51. In this

instance, the tamper evident band 52 is provided with a bead 53 which engages behind a shoulder 54 on the container top. Otherwise the construction and method of manufacture is similar to that discussed above.

Claims

1. A mould for forming a container closure having a cap and a tamper evident band of a diameter
5 substantially equal to or less than the diameter of the cap and attached thereto at circumferentially spaced locations by frangible bridges, comprising:
a core for defining the inner profile of said closure and having an external circumferential surface
10 portion arranged above a portion defining the inner profile of said band;
a sleeve which is mounted for axial movement with respect to said core and has an inner surface with a diameter substantially equal to that of said external
15 circumferential surface of said core, with grooves extending axially along said inner surface;
said core and said sleeve being adapted so as to be capable of assuming a relative position in which the sleeve surrounds the core with the portions of its inner
20 surface between the grooves in contact with the external surface of the core so as to define in the moulded closure a gap between the cap and the band, the grooves acting to form the frangible bridges in the moulded closure.
25
2. A mould as claimed in claim 1 wherein grooves extend along the sleeve to the extent that the bridges formed thereby in the finished closure extend along substantially the entire axial length of the band.
30
3. A mould as claimed in claim 1 or 2 comprising a third part , for defining the external profile of the cap, which, when the mould is closed, abuts on the upper surface of the sleeve.
35
4. A mould as claimed in any preceding claim wherein the upper surface of the sleeve is planar.

5. A mould as claimed in claim 3 or 4 wherein said upper surface extends radially inwardly of said third mould part.

5 6. A mould as claimed in any preceding claim wherein a shoulder is formed in the inner core above said circumferential surface portion in contact with the sleeve.

10 7. A mould as claimed in claim 6 wherein in the mould closed position, the shoulder is at the same level as the upper surface of the sleeve.

15 8. A mould as claimed in claim 6 or 7 wherein the arrangement of the shoulder and sleeve is such that the bridge is formed at about half the thickness of lower surface of the cap.

20 9. A method of making a container closure having a cap and a tamper evident band of a diameter substantially equal to or less than the diameter of the cap and attached thereto at circumferentially spaced locations by frangible bridges, comprising the steps of:

25 providing a mould having a core for defining the inner profile of said closure, said core having an external circumferential surface portion arranged above a portion defining the inner profile of said band, and a sleeve mounted for axial movement relative to said core and having an inner surface with a diameter
30 substantially equal to the external diameter of said circumferential surface portion of said core, with axially extending grooves formed in said inner surface;

35 closing said mould with said sleeve surrounding said external circumferential portion of said core such that the inner surface of the sleeve between said grooves is in contact with said external circumferential surface of the core and is spaced from said core therebelow to form a band forming cavity;

injecting plastics material into the mould such that plastics material enters both said grooves in said sleeve so as to form said frangible bridges and the cavity formed between the sleeve and the portion of the
5 core below the external circumferential surface portion to form the band;

axially moving said sleeve and said core relative to one another such that the sleeve no longer surrounds said band; and
10 removing the closure from said core.

10. A container closure comprising a cap and a tamper evident band arranged at a spacing from a lower edge thereof, said band having a diameter substantially equal
15 to or less than the diameter of the cap, and being connected to said cap by a plurality of circumferentially spaced frangible bridge members, said bridge members extending downwardly from said cap to form respective ribs on the outer surface of said band.

20 11. A closure as claimed in claim 10 wherein said bridge members are formed at a position about half the thickness of the lower surface of the cap.

25 12. A closure as claimed in claims 10 or 11 wherein the bridges extend along substantially the length of the band.

30 13. A container closure made in a mould as claimed in any of claims 1 to 8.

14. A container made by a method as claimed in claim 9.

35 15. A method of making a container closure using a mould as claimed in any of claims 1 to 8.

16. A mould substantially as hereinbefore described with reference to Figs. 3 to 12 of the drawings.

17. A method of making a container closure, substantially as hereinbefore described with reference to Figs. 3 to 12 of the drawings.

5 18. A container closure substantially as hereinbefore described with reference to Figs. 3 to 12 of the drawings.

- 14 -

Patents Act 1977
Examiner's report to the Comptroller under
Section 17 (The Search Report)

Application number

GB 9207514.2

Relevant Technical fields

- (i) UK CI (Edition L) B5A (AT14E, AF35); B8T (TTC, TTB)
- (ii) Int CI (Edition 5) B65D 55/02, 41/34; B29C 45/26, 45/44

Search Examiner

LINDA HARDEN

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

11 MAY 1993

Documents considered relevant following a search in respect of claims 1-18

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2022063 A (PLASTIVIT SA) Entire document relevant	1, 3-6, 9, 10, 13, 14, 15

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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